



Specification Design Life Requirements and Implications Relative to Boilers

Summary

This paper discusses and addresses the following:

- Background regarding usage of specification design life requirements;
- Meaning and expectations relative to specification design life requirements;
- Factors which may affect design life or anticipated life expectancy;
- Variations between manufacturers in addressing design life; and
- Limitations with respect to implications of specified design life or life expectancy requirements.

Specification requirements or specification language stipulating a Design Life -- or that the plant/equipment shall be designed (or provided) to achieve a particular Design Life -- are not new to the boiler industry either in the United States or internationally. Such requirements or statements have typically been included in specifications and contracts pertinent to the design and supply of boilers and steam generation equipment for at least the past 30-35 years.

Despite the common references or requirements regarding Design Life, however (and, seemingly, a generally-understood industry interpretation of such requirements), there is no universally-accepted published definition or reference regarding specified Design Life implications pertinent to boilers and/or power plants (and their included components). While specifications and contracts have typically included language identifying a Design Life or that equipment should be designed to achieve a stipulated Design Life, such specifications and/or contracts rarely (if ever) define the expectation or application of Design Life.

Further, the identified Design Life expectations (typically ranging from 20-35 years for boilers and power plants) far exceed the duration and/or expiration of typical specified equipment (or contractually-defined) warranties. Accordingly, specifications and/or contracts have not, as a rule, included or identified language or qualifications relative to defined expectations or obligations relative to Design Life, nor have they addressed liability or remedy with respect to Design Life.

The purpose of this paper is to articulate and document the generally-understood industry interpretation of and practices pertaining to specification Design Life requirements, and to provide ABMA guidelines as an accepted and defined reference for use by ABMA members and the industry regarding usage and associated implications of such specification requirements.

Power plants and boilers in particular have an expected (and have achieved) long-duration operational life, typically exceeding their specified Design Life expectations. Power plants and boilers are a major capital expenditure and the most common understanding (or interpretation) of specification Design Life expectations or durations is both to merely confirm an expectation of a long operational life as well as to define a period against which the capital and life-cycle costs will be evaluated.

Extended, long-term maintenance or long-term service contracts reflecting particular component life or maintenance-cost guarantees over the extended operational plant life have not been typically offered or applied to boilers. Such agreements have been offered and applied to particular power plant components (like combustion turbines), but, if offered (or provided), they are typically clearly defined as separate (from the supply contract) agreements subject to both additional compensation and conditions (both contractual and operational) establishing the obligations and liabilities of the parties.

Absent a corresponding extended (and clearly defined) operational warranty or other such long-term service or maintenance agreements, it is generally understood and accepted throughout the boiler and power industries (including many, if not most, major industrial plants that utilize boilers or have power plants) that the inclusion of an expected "Design Life" in a specification or contract does not impart or infer any additional warranties or supplier obligations beyond those specifically included in the contract.

All parties should be cautioned, however, that the issue and the exclusion of implied warranties is, in itself, a particular subject that should be separately and specifically addressed in the contract and is subject to applicable law and determination of the responsible court of jurisdiction.

Specification of Design Life for an overall project or boiler also does not represent or infer that the expected Design Life or life expectancy applies to, or even can apply to, individual components of the plant or boiler. While the specified Design Life may reflect an expectation of a long operational life of the equipment, as well as define a period against which the overall capital and life-cycle costs will be evaluated, it is also well recognized that any boiler or power plant will require ongoing maintenance, including the replacement of component parts, throughout its operational life. Periodic replacement or repair of various parts, often including major components, is a normal and expected occurrence. The normal or reasonable life expectancy of any component can vary greatly and is dependent on the component itself, its usage and the particular operational conditions to which it is subjected.

The expected life of any particular component, the extent of required maintenance and incidents of required replacements are greatly dependent on a number of highly-variable factors, including operational considerations as well as the diligence of the owner/operator in inspecting and properly maintaining the plant and its component equipment. It is well recognized and accepted throughout the industry that operation of the boiler outside of its specified design parameters can dramatically effect (and adversely impact) the life expectancy of the boiler and/or its components.

Ongoing maintenance, preventive maintenance and/or multiple replacements throughout the operational life of the plant may be necessary and appropriate depending on the particular component and operational conditions. Failure to diligently inspect and/or to maintain the equipment, to provide for appropriate preventative maintenance or to take mitigating action to address wear and degradation can lead to component failures, necessitate premature repair and replacement, or lead to a reduced overall life expectancy of the plant or its components.

Given the variability of and the inability to control these factors, boiler (or boiler component) suppliers typically exclude or make no warranties or representations with respect to erosion, corrosion, or excessive wear with respect to the boiler or its component parts. All parties should again be cautioned, however, that this reflects a commercial matter which should be addressed in the contract and, in the event of a dispute, will be subject to applicable law and determination of the responsible court of jurisdiction.

Conversely, a specified Design Life does not necessarily or inherently dictate a finite life expectancy or mandatory retirement of the plant or boiler equipment. Except as may be provided by law or pertinent Codes other than ASME, many power plants, including their boilers (which may benefit from ongoing maintenance, including periodic replacement of their major components), have demonstrated operational life expectancies and the ability to remain economically viable well in excess of typical specification Design Life requirements. While ABMA does endorse the careful consideration of the potential economic and environmental benefits associated with the retiring of aging equipment and the replacement of older equipment and systems with new, more efficient and environmentally-effective state-of-the-art equipment, pending enactment of new legislative or court-directed mandates, such decisions remain within the purview of the plant owner/operator.

In any set of circumstances, major considerations in evaluating or considering the Design Life, life expectancy, operating costs or projected maintenance of any power plant, boiler or any other power plant component will be the expected or specified service duty of the plant and/or component, rather than the plant (or component) design or performance capability and the specified operating conditions of the plant and/or component. Such considerations include not only the expected availability (ability to be “available” to meet demand) but also the expected capacity factor (average or typical output as compared to design capability) and expected load profile. Few, if any power plants (or boilers) -- even base-load plants with high availability -- are operated continuously at their design capacity or performance capability. Cycling, peaking or standby plants (or their components) may be required to operate at their design capacity (or performance capability) for short periods, but their actual capacity utilization (or average load) and service duty would be significantly lower.

Accordingly, the expected (or specified) service duty of the plant and its equipment is a significant design consideration with respect to addressing Design Life or component life expectations. Even though their stated Design Life might be the same, the actual life expectancy of a plant (or component) originally and appropriately designed for a specified service duty or average load would typically be foreshortened (sometimes quite considerably) if the actual service duty/average-load requirements are increased as compared to a plant (or component) that was originally designed or provided to accommodate a more strenuous service duty or average load.

In conjunction with the service duty, variation in the fuel types, expected fuel quantities and mix of fuels (for multiple-fuel plants), and fuel quality will also have a direct bearing on the Design Life, life expectancy and maintenance costs of boilers, the individual components of boilers, as well as related power plant equipment. The actual life expectancy and maintenance costs of a boiler (or its individual components) that is appropriately designed or incorporating appropriate design features to accommodate a particular (or specified) fuel, mix of fuels, quantity and quality of fuels can be (and typically is) drastically impacted by changes in the fuel type, mixture, quantities and qualities.

The quantities of fuel fired are also directly related to the specified service duty of the plant and/or boiler. Boilers may be and, in fact, commonly are designed with a fuel firing capacity or capability well in excess of the average or nominally expected throughput to provide for operational flexibility, periodic maximum load demands or even to offset periods where the firing of a particular fuel is discontinued to accommodate periodic cleaning and/or maintenance relating to that particular fuel. The overall Design Life, life expectancy and expected maintenance costs of the boiler (and its components) are, however, more directly related to and reflect the expected service duty and expected quantities of fuel to be fired over the operational life of the plant, rather than the maximum fuel firing design capacity or capabilities.

Fuel quality and the fuel constituents have a direct and substantial effect on erosion, corrosion and wear of multiple components as well as the operational capabilities of the boiler (and related systems or components). Consideration of the fuel, and combination of fuels, is a major consideration in the design of any boiler system. Changes in fuels that differ from design can and typically will have a substantial impact on the expected life of the boiler and rates of wear on various components, necessitating additional maintenance and/or premature replacement, or, in some instances, requiring redesign and replacement of components or systems, as appropriate, to accommodate the differing fuel.

Likewise, there are a number of additional factors that can impact on the life expectancy of any boiler or its components, including (but not limited to) boiler water quality and chemistry, transient operations (frequency, quantity and rate of transients), control of excess air levels and other such operational issues.

Accordingly, it is generally understood, and it is ABMA's position that a specified Design Life reflects and is limited to an expectation of a long operational life of the equipment, as well as defines a period against which the overall capital and life cycle costs will be evaluated. It should also be recognized, however, that given the variability of multiple factors --the majority of which are beyond the control of the supplier -- Design Life specification references of a general nature cannot realistically define or infer a finite or extended life expectancy of a boiler or any of its components beyond what may be expressly warranted or specifically defined in a contract. This is the common and typically understood interpretation throughout the industry, both in the United States and internationally, and is accepted by ABMA, regarding the usage and implications of Design Life references in specifications and contracts relating to power plants and/or boilers.

Further, the particular design of the power plant and the equipment furnished and any expectation of Design Life would be based on and reflect the expected service duty and specified operational conditions as specified or defined in the contract. It is also well recognized that any boiler or power plant will require ongoing maintenance, including replacement of component parts throughout its operational life. Periodic replacement or repair of various parts, often including major components, is a normal and expected occurrence.

Each individual supplier, however, may incorporate considerations and features addressing Design Life and maintenance in its offerings and product design. Such considerations and features can and will vary considerably between differing manufacturers, dependent on their overall design approach, evaluation of capital cost vs. life expectancy, maintenance cost considerations, and particular customer requirements, as well as reflecting the expected service duty and operational factors as previously outlined. There is no universal or industry-accepted standard with respect to the necessity or appropriateness of any particular design practice, feature or the superiority of product design with respect to addressing Design Life and/or life-expectancy requirements. Accordingly, such particular features and designs do vary from manufacturer and are typically determined, offered and negotiated on a project specific basis. ABMA takes no position and makes no representations relative to the appropriateness, necessity or benefit of any particular design or feature, nor any particular supplier or product design.

Given the lack of universal or industry-accepted standards with respect to particular requirements, design practices or features addressing Design Life, as well as the uniqueness of each supplier and each particular application, it should be understood -- and it is ABMA's position -- that specification Design Life and/or life expectancy requirements cannot and do not infer the inclusion or expectation of any specific product feature or design practice; nor do they impose or extend any obligations beyond those that are clearly identified, delineated and agreed upon between the respective parties as incorporated in the resultant contract.

Again, and given the variability of multiple factors, any predictions of long-term life expectancy or maintenance estimates for any component of a power plant, including boilers and their various components, is a very uncertain process.

The foregoing whitepaper is a product of the Product/Market Group Planning Committee of the American Boiler Manufacturers Association (ABMA). It is offered as information only. The ABMA does not assume responsibility or liability for consequences arising from the implementation or failure to implement the information contained therein, and the contents of this whitepaper should not be construed as an endorsement by the ABMA of any particular product or manufacturer.

The American Boiler Manufacturers Association is the national, nonprofit trade association representing the manufacturers of commercial, institutional, industrial, cogenerating, heat recovery, and electricity-generating boilers and combustion equipment, the providers of products and services used by the boiler industry and users of boiler equipment. In short, ABMA represents the companies that design and build the fuel-flexible and efficient systems that combust the fuels that generate the steam and hot water that powers and comforts America and the world.

Readers should also consult the ABMA Online Bookstore at www.abma.com for additional material on this and other technical questions, and the ABMA Online Buyers Guide for quality goods and services associated with boiler-generated steam and hot water.

© American Boiler Manufacturers Association, 2010